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ABSTRACT

This paper explains the similarities and differences between electronic mail and computer conferencing, and identifies the features one should look for in a modern conferencing system. It also clarifies some related terminology. Advantages of computer conferencing are first outlined, including: time- and space- independence; text-based medium; permanent recording; document transfer; decreased turnaround time; access to online resources; an egalitarian context; improved access; overcoming social isolation and increasing emotional involvement; potential for improved participation; opportunity for increased interaction; enabling cooperative and collaborative group work; and enabling knowledge-building. Disadvantages of computer conferencing include the cost of technology; learning curve; technical difficulties; frustrations with group work; information overload; time spent online; and possible low levels of interaction. The following desirable features in computer conferencing software are then described: user-friendliness; cross-platform compatibility; basic word processing capabilities; client-server design; document transfer; conversation threading; ease of administration; digesting; affordability; high quality documentation; off-line work; multimedia capability; address book; batch processing; forms creation and integration; transparent integration with the Internet and World Wide Web; and chat. (Contains 14 references.) (AEF)

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A Beginner's Guide to Computer Conferencing

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Paper presented at the Annual Conference of the Association of Educational Communications and Technology, Albuquerque, NM, February 12-17, 1997.

Abstract

Two-way communication is the very essence of teaching and learning. A number of technologies are available today that provide one-way communication, but relatively fewer afford adequate two-way exchange that is easily accessible and affordable. A two-way communication technology that has recently created considerable interest--especially in distance education where asynchronous communication is important--is computer conferencing (CC). Many educators believe that computer conferencing is simply the exchange of electronic mail between and among teacher and students, and--more often than not--from teacher to student. In its most rudimentary form, CC is that, of course, but it can also be a good deal more. Certain features not commonly found in e-mail systems are available in today's CC software that make conferencing qualitatively different, as well as easier, than group e-mailings or listservs. This paper explains the similarities and differences between e-mail and computer conferencing, and identifies the features one should look for in a modern conferencing system. It also clarifies some related terminology.

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Abstract

Two-way communication is the very essence of teaching and learning. A number of technologies are available today that provide one-way communication, but relatively fewer afford adequate two-way exchange that is easily accessible and affordable. A two-way communication technology that has recently created considerable interest—especially in distance education where asynchronous communication is important—is computer conferencing (CC). Many educators believe that computer conferencing is simply the exchange of electronic mail between and among teacher and students, and--more often than not—*from* teacher *to* student. In its most rudimentary form, CC is that, of course, but it can also be a good deal more. Certain features not commonly found in e-mail systems are available in today's CC software that make conferencing qualitatively different, as well as easier, than group e-mailings or LISTSERVs. This paper explains the similarities and differences between e-mail and computer conferencing, and identifies the features one should look for in a modern conferencing system. It also clarifies some related terminology.

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Fundamental to the teaching-learning process is the notion of communication. While ideas can be and are communicated via so-called "one-way" communication technologies (e.g., print materials, radio and television, most audiovisual media), for many people the very essence of teaching and learning is an exchange of ideas, a "two-way" communication. Heretofore, two-way communication has required that two or more participating individuals be either or both spatially and temporally proximate. Some two-way communication technologies require that both parties be in a given place—either the same place, as in face-to-face communication, or in different places, as in audioconferencing, or one-way or two-way audio-video conferencing. Other two-way communication technologies permit participants to be in different places, but require that they be there at the same time, such as computer-based videoconferencing or Multi-User Dimensions/on-line discussion groups. Relatively few technologies exist that permit participants both spatial and temporal independence. Those that exist are based on networked computers: newsgroups, electronic mail (e-mail), and computer conferencing (CC).

With the growing trend toward removing education and training from the traditional classroom environment and delivering it to either the workplace or home—so-called "on-demand" education and training—there is growing interest in the use of two-way, temporally- and spatially-independent communication technologies. While e-mail has been around for nearly a quarter-century (at least in rudimentary, intra-system form) it is only since the advent of the Internet that it has become practicable as a two-way communication system for instructional purposes. A variant of e-mail, computer conferencing, provides specific capabilities and features not commonly found in e-mail systems, and makes it easy for individuals not facile with computers to engage in time- and space-independent teaching and learning.

The similarities between e-mail and CC are numerous, thus the distinction between the two is lost to many. This paper attempts to lessen the confusion by addressing the following questions:

- What exactly is computer conferencing?
- How does it differ from electronic mail and some other computer-based technologies?
- What are the advantages and disadvantages of computer conferencing?
- What features and capabilities should you look for when considering a computer conferencing system?

Terms and Acronyms

Computers have always had associated with them a plethora of technical terms and acronyms that have tended to confuse educators—especially when they are not used in consistent ways. In particular, there is commonly confusion between computer conferencing (CC) and computer-mediated communication (CMC), and the terms are often (and incorrectly) used interchangeably. Before proceeding, therefore, we will define some terms and acronyms we intend to use.

Computer Conferencing vs. Computer Mediated Communication

Computer conferencing is the use of an enhanced electronic mail environment to establish communication—asynchronously or synchronously—among participants who may be separated by time and/or distance. Computer conferencing allows a student to engage in individual communication with another student or with the instructor, or to participate in group communication with other students and the instructor. The communication may take place via a single multi-user computer or via multiple computers connected by a network.

Computer-mediated communication is a more-encompassing concept. CMC typically includes:

- person-to-person communication using computers, such as electronic mail (e-mail), electronic bulletin boards, and computer conferencing
- person-to-computer communication, such as accessing the World Wide Web (WWW) or databases
- person assisted by computer, as in computer-assisted instruction (CAI) or computer-based training (CBT).

Computer Conferencing vs. Electronic Mail

There are a large number of similarities between computer conferencing and e-mail, and a few crucial differences. For all intents and purposes, the actual messages that make up a conference are identical to individual e-mail messages. The major differences in the two systems are in the ease with which group and sub-group communications are effected and in the amount and kind of administration necessary to support the conference (which is typically done by the instructor). Most everything that can be done with computer conferencing software can be done with e-mail software, but usually with considerably more effort and difficulty. The basic paradigm is that of sending a message to one or more individuals simultaneously, and their reading it and responding either to the sender or to many individuals, in like manner.

Since asynchronicity is part of the CC paradigm, there are likely to be a number of different conversations going on simultaneously (i.e., during the same time period—say, a week). Whereas an e-mail system cannot elegantly deal with multiple simultaneous threads of conversation, CC can and must. While e-mail can accommodate sending messages to multiple recipients, it must do so through rather crude means such as creating group lists or using LISTSERVs. CC generally handles such problems with more panache. It should be noted, however, that this ability to elegantly and easily organize and manipulate large volumes of interconnected, asynchronous communications, has in fact been incorporated into some contemporary e-mail software packages.

Contemporary CC software can also include a number of capabilities not commonly found in e-mail systems, such as following individual threads of conversation automatically, creating sub-groups of recipients quickly and easily, or controlling who can and cannot read or respond to various messages. Space doesn't permit a full description of them here, but a fairly comprehensive depiction of a contemporary CC software package is available in Misanchuk, 1997.

Computer Conferencing vs. Newsgroups

There are also some similarities between computer conferencing and newsgroups found on USENET. USENET newsgroups are similar to conferences, and threads within the newsgroups are similar to threads within conferences. Messages may be addressed to certain USENET newsgroups or to certain CC conferences. Perhaps the major difference between CC conferences and USENET newsgroups is that the latter are typically open to anyone who wishes to join them, and are unmoderated, whereas the former typically have closed (controlled) subscription lists and are virtually always moderated, at least in instructional situations. Another difference lies in the ability of CC conferences to have sub-conferences within them, whereas newsgroups generally do not.

Advantages of Computer Conferencing

There are a number of advantages that accrue to computer conferencing. Some are advantages shared by other delivery systems, but some are unique to CC. Some of the advantages are directly related to the characteristics of the technology itself—administrative, logistical, and hardware/software-based advantages, which might be called "hard" advantages. These are that computer conferencing:

- is time- and space-independent;
- is primarily a text-based medium;
- provides a permanent record;
- enables document transfer;
- decreases turnaround time; and
- allows access to on-line resources.

Other advantages of CC have more to do with pedagogy and process—what we call "soft" advantages. Computer conferencing:

- provides an egalitarian context;
- improves access to education;
- overcomes social isolation and increases emotional involvement;
- has potential for improved participation;
- provides opportunity for increased interaction both with the instructor and with peers;
- enables cooperative and collaborative group work; and
- enables knowledge-building.

Time- and Space-Independence

The very nature of CC does not require that conferees be in a particular place at a particular time. Indeed, they need not even be in the same place at different times, so long as they can still access the necessary software from their current location. The asynchronicity of CC means that learners' schedules can be more flexible than with most other instructional delivery systems.

Text-Based Medium

Text is a familiar medium to most learners, thus "friendly"; there are relatively few new skills to be learned before participation is possible. With the capability of either

including or attaching multimedia components or documents, however, the range of possibilities broadens.

Permanent Record

Each and every word contributed to the discussion is retained (unless, of course, the teacher or system administrator deletes it on purpose). Thus reviewing what was said, and by whom, when, and in what context, becomes a fairly straightforward, albeit potentially tedious, matter. For example, the instructor can reorganize past discussion threads into groupings, based on themes or central topics, which can be archived as learning resources for following cohorts. This ability to use the past contributions to conferences for powerful pedagogical purposes may be an under-utilized advantage of computer conferencing.

Document Transfer

Plain or formatted text and multimedia documents can be attached to messages to act as source materials that learners can print, view, or play on their desktop computers. Free or reasonably-priced multi-platform document delivery software is becoming increasingly common, so the type of machine the learner has is becoming irrelevant. Thus instructional materials can be posted on the CC system without regard for whether the learner has a Mac or a PC; the learner can simply download both the document and the necessary software for printing, viewing, or playing the document on the particular model of computer receiving it.

Of course, document transfer capability also enables learners to submit their assignments electronically for grading. A continuing problem in this regard is the fact that some word processors will not seamlessly and accurately interpret documents created by competitors' word processors, necessitating a lowest-common-denominator approach such as using ASCII or RTF file formats, or requiring all users to use the same word processor.

Decreased Turnaround Time

Questions can be asked and answers provided in much less time than would be taken in most print-based distance education environments. Assignments can be "mailed" in through the document transfer capability, graded, and returned the same way, eliminating the postal or delivery delays common to print-based distance education.

Of course, the other side of the coin is that this puts unprecedented pressure on the instructor. Learners in a CC environment very quickly display an expectation of immediate access to the instructor, and/or very quick turnaround time on submitted assignments. If an instructor doesn't respond to a message within 24 hours, learners can get quite upset. Instructors must learn to notify their classes if they are going to be inaccessible to the CC system for more than a few hours, or risk incurring their wrath.

Access to On-Line Resources

Course-relevant resource materials can be posted on the CC system by either the instructor or students. In addition, given a CC system operating on the Internet, or at least easily connecting with it, all the electronic resources comprising the Internet become potentially available to learners. Some libraries have on-line card catalogues

and database search capabilities; others provide e-mail-order photocopying services of source documents. Some academics now post their papers on the World Wide Web as well as publishing them in academic journals, making them quick and easy to download. Students can then integrate these on-line resources with what they are doing in the computer conference. The possibilities for peer-constructed, authentic, and timely knowledge within such a learning environment are enormous.

An Egalitarian Context

Since learners deal primarily with text, social cues about the contributor are minimized, and a more "level playing field" among participants obtains. For example, perceptions based on knowledge of age, race, gender, and other potentially biasing factors are effectively removed from the conversation; hence, on-line contributions are more likely to be judged on the basis of their content, rather than on extraneous (and irrelevant) factors. While some would argue that the removal of communication cues such as body language and paralanguage (e.g., intonation) result in diminished communication, we suggest that the benefits of removing biasing factors more than compensates for the losses. Furthermore, emerging in electronic communications are creative text-based cues which at least partially make up for some of the lost non-verbal cues. For example, so-called emoticons such as :-) , meaning "I'm kidding", or the use of asterisks before and after a word to indicate verbal *emphasis*, are making their way into common use.

Improved Access

Bates (1995) suggests that delivery directly to the home is one of the best ways to increase access to education. Home-based course delivery, primarily in the form of print-based course packages with some supporting technologies, has been the norm for many years. The main problem with this delivery method has always been the typically low level of opportunity for interaction. It is clear that a course based on computer conferencing increases the amount of interpersonal support we can provide learners and radically increases potentials for interaction. At its most fundamental level, access is improved because computer conferencing can break down the isolation distance students may feel.

Another way to look at access is to examine what the technology can do to connect students with resources outside the constraints of the individual class. Computer conferencing can, for example, give a student access to an audience well beyond the immediate CC environment. For example, McMahen and Dawson (1995) report computer conferencing linked school children from geographically distant schools in order to investigate water quality in their common watershed. They were able to pool their data on water quality and the effects of various influences on that water quality. This potential for connecting with other groups or individuals is an area in need of further exploration and holds the key for some very powerful access experiences not readily available within the confines of other delivery technologies.

Overcoming Social Isolation and Increasing Emotional Involvement

The sense of isolation from peers, and indeed from the entire educational institution, is a common negative factor in most students' experiences with traditional distance education contexts. Without the opportunity to actively interact and exchange ideas with each other and the instructor, students' social and emotional, as well as cognitive, involvement is diminished. By constantly reading others' messages and posting

responses in the public "space" that is the conference, students are less likely to remain isolated (unless by non-participation) and may even become more emotionally involved in the on-line dynamics than would be the case in a face-to-face classroom environment.

Potential for Improved Participation

Providing every learner with the opportunity to engage in the conversation without regard for strictures of time and space holds the potential for increased participation in the discussion. The more verbose may not be able to dominate the conversation as easily they could in a face-to-face situation; less assertive or more reflective students and individuals for whom English is a second language find it easier to become part of the discussion (Harasim, 1987, 1990, 1993). It may even hold true that the interaction that takes place in the computer conference is of better quality than that in the traditional classroom (Harasim, 1987).

Of course, there is a down-side to the increased participation afforded by CC, just as there would be if everyone were allowed and encouraged to talk at the same time and in the same quantity in a classroom—the sheer volume of verbiage increases dramatically. Instructors in a CC environment quickly learn that they need to develop strategies for increasing quality of interaction while decreasing quantity, lest they (along with their students) succumb to information overload. Such strategies might include modelling on-line behaviour, setting limits for message length (e.g., no more than two screens), or developing a grading system that rewards relevant message responses.

Provides Opportunity for Increased Interaction

Moore (1986) distinguishes among three types of interaction: interaction with content; interaction between learner and instructor; and interaction among learners. CC particularly provides the opportunity to increase the latter two types of interaction. The exchange of ideas between and among cohorts, as well as between learners and instructor, can take place in a context in which others can choose to either participate or observe.

Computer conferencing provides learners with unprecedented access to the instructor, who is always only a message away. "Keeping office hours" for student access becomes an irrelevant notion, a thing of the past. Furthermore, unlike a classroom situation, "stupid" questions can be asked in relative privacy and consequent decreased threat. Hiltz (1989) claims learners feel more comfortable about contacting the instructor through this medium than in person; it seems to foster a friendly and egalitarian interaction. This seems to hold true in our own experience: in one CC-based course, students felt that it was disruptive to contact their instructor in her office, but not so when contacting her through the computer conference.

Opportunities for interaction among learners is an important element of cognitive development. The basis for course discussion is the written text, mediated by the power of the computer-mediated communications. Unlike the face-to-face classroom, however, there is no competition for "air-time" in a computer conference; participation in the dialogue, then, becomes easier and more likely (Harasim, 1987). Computer conferencing may provide for increased reflective thinking because of the written text and the atemporal nature of the medium (e.g., learners are not "put on the spot" for an immediate, off-the-cuff response as they might be in a face-to-face classroom). It should be noted that while computer conferencing adds an interactive element to distance

education hitherto not possible, it can also serve to enhance dialogue when used as an adjunct in a face-to-face situation like an on-campus class.

Enables Cooperative and Collaborative Group Work

Collaboration is a skill increasingly demanded by employers. It is also a skill that can be taught and fostered. Harasim (1990) suggests that CC is uniquely suited to the support of cooperative and collaborative group work. CC's capability of forming sub-groups of learners (be it dyads, triads, or any number of learners) can be used to good effect in group work. The ability to effectively isolate one group's work from others makes it easy for group members to feel comfortable that they aren't constantly under the scrutiny of their peers or the instructor. Computer conferencing enables group work by removing the necessity of having all the group members together in one place at one time.

Enables Knowledge-Building

There has been much recent talk about the need for a constructivist approach to education, and about the need to facilitate collective knowledge building based on collaboration. There may be many reasons why these goals aren't realized more often, certainly too many to deal with here. However, given the nature of the medium of CC, its potential as a platform on which to build a contextualized, relevant, and shared base of knowledge among participants is important. Models encouraging the progressive compilation of peer-collected and -evaluated information, which in turn is processed through the mill of ongoing collective dialogue and critique, finally ending in the construction of mutually-owned knowledge structures are available and seem easily adapted to this technology. Further application and research into this exciting aspect of computer conferencing is needed.

Disadvantages of Computer Conferencing

As is the case with most new technologies, reports on computer conferencing applications to education have, for the most part, been positive. Much has been made of real or imagined advantages, and many glowing predictions have been put forward. However, computer conferencing is not without its shortcomings. Some of these may be relatively short-term (e.g., the cost of the technology and consequent limits of accessibility for some); others may take some time before they are ameliorated or before learners and instructors alike learn to minimize them (e.g., information overload).

Cost of Technology

CC software can be quite reasonably priced, although some packages are prohibitively expensive on a per learner basis. Overshadowing software costs, however, is the cost of the hardware. Computers cost significant amounts of money. So does their connectivity (e.g., access to the Internet or local-area network). Although the amount of desktop computing power per dollar is many hundreds of times greater today than it was a decade ago, there still is a substantial entry fee required to join the club of technology. This raises the specter of lack of universality of access. An ethical question arises: By requiring learners to have computers and connectivity (either modems or Internet access), are you denying some segment of the population access to your course? There seems to be no easy way around this problem: making the CC component optional is not likely to be effective (Misanchuk, Peterson, and Morrison, 1997).

With constantly lowering prices for ever-increasing computing power, the hope is that eventually computer conferencing capability will become as ubiquitous as the telephone.

Learning Curve

Even the easiest-to-learn CC programs will necessarily require some learning on the part of both learners and instructor. Some of the less user-friendly CC programs may require a considerable investment in learning how to use the technology.

As with any innovation, a certain segment of the population will take to the technology with alacrity, while others will remain resistant or at the very least fearful. At minimum, would-be users of CC-based courses must recognize the need for a familiarization period, in which learners can use the technology in a relatively low-pressure situation (e.g., getting students to post short autobiographical pieces, fulfilling the dual role of practice with the technology and facilitating introductions to each other). Expect students to need about 2-5 hours to master the basics, and at least five hours to feel comfortable with the conferencing environment (Hiltz, 1986). Instructors, on the other hand, may need up to 30 hours or more to learn the advanced features required for their role as instructors and moderators (Hiltz, 1986). As conferencing systems have become more advanced since the time of Hiltz' report, the technology may currently be easier to learn and use.

Unfortunately, our experience has not been mollifying in this regard. Some learners (both within on-campus and distance education university courses, as well as in professional-development conferences) seem quite universally inclined to leave things to the last minute. As deadlines loom and technical problems arise, frustration and tension levels zoom. Perhaps all that can be done in this regard is for instructors of CC-based courses to make clear, at the course onset, the importance of working early and continually with the CC software. Better yet, the instructor or course designer can build in relevant on-line exercises that both fulfill content objectives and facilitate gradually increased competence with the CC software.

Technical Difficulties

Even with the most robust CC system, technical difficulties can—and will—crop up. Given the fundamental human characteristic exhibited by some learners to leave things to the last minute, most of the technical difficulties can be expected to appear at the very worst times, when learners are under pressure of deadlines. These times frequently are therefore outside "normal working hours", when technical assistance might be least available, thereby adding to the stress of the situation.

The way to avoid, as much as possible, the problems associated with technical difficulties is to have both excellent instructional materials and technical support consultants. Software manufacturers' documentation isn't always adequate; you may have to write your own, or at least supplement what is available. People with skills in technical trouble-shooting may not have the requisite "people" skills; they may have to be trained.

Students themselves can and do help each other (sometimes more effectively than tech support personnel or instructors!) with general technical problems, something which should be encouraged. Including a FAQ (frequently asked questions) folder in the conference is a good way to avoid repeat questions regarding basic procedural problems.

Frustrations with Group Work

Group work itself, whether in a CC environment or not, can be a source of confusion and frustration to learners who have not had positive and productive experiences with that form of learning. Although current demand from business and industry is for employees who can work in groups and teams, most adults have been raised in, and feel most comfortable with, the culture of the past several decades which reinforced individual competitive effort. Thus learners may have to be taught how to work effectively in a group setting, especially when that group work is on-line. Special attention needs to be devoted to coordination, decision-making, task allocation, and other group process plans. The instructor, who will need to encourage and allow time for group formation, has clear responsibilities regarding the establishment and maintenance of safe, functional on-line groups.

Information Overload

Information overload in a CC course is a very real possibility, both for learners and for the instructor. If everyone in the course generates even just a little bit of information, everyone has to read everyone else's contributions. Of course a realistic (perhaps even somewhat cynical) look at the situation should predict the outcome: If you foster and encourage interaction, people will interact! The more learners are involved, the more information is generated—a fact one might want to keep in mind when setting enrollment limits in CC courses! If students spend increasing amounts of time trying to stay on top of the deluge of messages coming their way, they are unlikely to be able to focus on the content and contribute in a meaningful way to the discussion. Instructors might try various strategies to avoid the information overload in the first place. One such strategy might be to put strict limits on the number of messages any student can post in any particular conference area (other areas can be havens of verbosity but have less to do with the purposes of the course). Another might be to break the whole course into smaller sub-groups, requiring weekly summaries from each to be posted to the main conference area for discussion.

Experience by some educators involved in CC indicates that teaching a CC course for the first time, at least, involves one and one-half to two times as much work as teaching the same class face-to-face (Penn State, 1996). This can have serious implications for workload, remuneration, and promotion considerations for any faculty member or professional considering teaching on-line.

The lack of any clear information management strategies contribute to the problem of information overload. Most learners (perhaps most instructors, too) do not have adequate information management skills to cope with the deluge of messages that CC can produce. The instructor may also have to consider formally teaching information management strategies and skills as part of the course.

Time Spent On-Line

Concomitant with the amount of information one has to deal with in a CC course is the amount of time needed doing it, both for the instructor and for students. An almost-universal reaction for first-time CC users is "I never thought it would take so much time!" Some CC software permits off-line browsing and composing of messages, a highly desirable feature for those who access the system by modem and may face toll charges doing so. Even with local calls, unless the learner installs a separate telephone line for modem use, the amount of time the phone line is tied up may interfere with day-to-day

routine. Realistic workload expectations from the instructor/course designer, taking into account the amount of work involved in full participation in a CC course, is a necessary first step toward reducing an often onerous and unrealistic amount of time spent on-line.

Possible Low Levels of Interaction

Interaction is not likely to take place on a widespread basis without some overt actions to foster it. The dominant environment of teaching and learning we have all been exposed to for so long (classroom lectures) may encourage interaction to some small degree, but even the most seminar-like atmosphere poses limits on how much each individual is reasonably allowed to say without interfering with the contributions of others. Thus most people have learned through experience to keep relatively silent when learning in a face-to-face environment. Unless specific steps are taken by the instructor, that behavior is likely to transfer to CC courses as well. Hiltz (1989) suggests that the level of interaction may be related to "cognitive maturity;" students who are described as cognitively immature want a voice of authority to give them the right answer or tell them, at every step, what to do next. It may be helpful to think of learners' comfort with and desire for interactivity with peers as a continuum which, over time, progresses from one of cognitive immaturity to cognitive maturity. Instructors can take steps to encourage that development by offering a high level of structure at the beginning of the course, followed by more free-wheeling but highly interactive exercises as the course progresses. Research is needed to investigate more thoroughly how we can best structure CC learning environments for optimal learning.

Desirable Features in Computer Conferencing Software

Below are some highly desirable features of CC software, in more or less what we consider the decreasing order of importance for most users (although your ranking of importance may vary depending on local circumstances).

User-Friendliness

The most important feature of a good CC system, to our minds, is encapsulated in the much-overworked term *user friendliness*. By this we mean that the CC component is consistent with and true to the "normal" interface of the operating system on which it runs, and that it has an intuitive, natural "feel" with respect to the task to be accomplished, that doesn't require users to think or act in unusual or uncommon ways. Usually, the best CC software will have a graphical user interface, although if circumstances require it (e.g., the use of "dumb" terminals or non-standard operating systems), a command-line interface should be available as well.

Good CC software will require relatively little learning on the part of the students (since the use of the software is merely a means to an end, not an end in itself), and will be easy to continue to use, not just easy to learn.

Cross-Platform Compatibility

The CC software should ideally run on as many different kinds of desktop operating systems as possible. At minimum, it must be capable of running on both Macs and Windows machines. If necessitated by local circumstances, some provision should be made for "dumb" terminals or use on other operating systems as well.

Basic Word Processing Capabilities

Basic word processing functions should be supported. At minimum, this would include a WYSIWYG view; the use of different fonts, sizes, and styles; mouse-based navigation and selection; cut, copy, and paste; tabs and rulers; and left-, right-, and center-justification. CC documents should be able to be alternatively saved as ASCII documents.

Find and Replace commands would be nice to have, as would a spelling checker. Built-in rudimentary graphics would be a bonus, as would simple use of color.

The word processing capabilities should be accessed and should function the same way on all platforms, yet be consistent with the look and feel of other software on each platform.

Client-Server Design

The most efficient architecture for CC systems is that of client-server. In this design, a centrally-located computer, called the server, runs special software that permits it to be accessed by a number of client computers simultaneously. The client machines run special software capable of interacting with the server.

Client-server CC systems will generally have only a single copy of a message on the server, accessible to all of those to whom the message is addressed, rather than sending multiple copies of the message as LISTSERVed e-mail systems usually do. Local intelligence in the client machines provides a wide range of capabilities while minimizing the actual amount of interaction required with the server, thereby increasing the efficiency of communication between the two. Ideally, clients should be able to connect to the server via modems, local-area networks, wide-area networks, and/or the Internet.

In choosing CC software, take into consideration both the per-user software costs and the type, size, and cost of the server software and hardware that will be required, as well as the availability and cost of the technical expertise required to maintain and operate the system.

Document Transfer

A good CC program should have the ability to transfer formatted text and multimedia documents from one user to another, conveniently and transparently. The transfer capability should permit multimedia documents either to be embedded in a message or to be attached to one. The user should not be required to encode or compact files before sending them or decode or unpack them upon receiving them; the CC software should take care of all that without bothering the user.

Threading

Have you ever carried on two or more conversations simultaneously? For example, you might be talking to someone on the phone while simultaneously discussing something entirely different with someone else beside you. Such conversations are difficult to keep track of. We call each separate discussion a *thread* of conversation. As you can imagine, in a computer conference, there could be several different threads of discussion going on simultaneously. To further contribute to confusion, in computer conferencing

different participants in the conversation add their comments at different times, often spread out over several hours, days, or sometimes even weeks. Since the conversations are asynchronous (i.e., occurring at different times), it could be a real challenge to figure out what earlier conversation a given comment refers to. Good CC software contains a mechanism for keeping track of the different threads, and permits users to follow a single thread from start to finish, while temporarily ignoring messages belonging to other threads.

Ease of Administration

As important as it is for CC software to be easy for the student to learn and use, it must also be easy to use for the system administrator, and especially for the instructor, as well. Creating and assigning powers to new users, conferences, and sub-conferences should be quick and straightforward, yet still provide a range of controls if desired. The delegation of powers to instructors by the system administrator should be quick and easy and should require minimal learning on the part of the instructor.

Arguably, it is somewhat less important that it be easy to learn for the instructors and administrator than it is for students, since their repeated use of the system will represent payoff greater than for students. However, the very best CC systems will be as easy to learn for instructors and administrators as it will for learners.

Digesting

A digest is a compilation into a single document of all the messages relating to a single thread, usually in chronological order. Digests are the tangible equivalent of the threading function described above. They are useful for summarizing and reviewing discussions. Ideally, a mechanism should exist in the CC software to assemble a digest quickly and easily. In addition to each message, the digest should contain the name of the sender, and the date and time at which the message was sent.

Affordability

Money is, of course, a very important concern. In comparing the costs of various systems and software, however, it probably shouldn't be a dominant concern. Buying into a system that won't do what you need it to—or will do it more poorly or less efficiently—simply because it's the least expensive, is a trap you want to avoid.

In considering affordability, you must not only take into account the hardware costs and licenses for both the server and client software, but also the incremental costs associated with "growing" the system. In order to do this, you must attempt to make a realistic projection of the ultimate size of your CC system, not just the initial size. With some software, incremental costs are such that they can easily overshadow the savings realized in initial costs.

High Quality Documentation

Software documentation is often overlooked as a component of the CC system. Yet you must remember that every learner and every instructor new to the CC system will need to learn from it. With distance education students the excellence of documentation becomes an even more crucial element than with on-campus students, who have peers at hand from whom to learn. The documentation must make it easy for an absolute

novice to install, to learn to use, and to continue to use. It is common to give less attention to the first two of those criteria in favor of the third, because (the rationale goes) once you've got it installed and learned how to use it, the on-going payoff comes in it being easy to continue to use. However, the circumstances are different in the case of CC: Most of the learners will be at a distance, hence unable to access help to get the software installed; and the CC software probably will **not** have continuing payoff for the learners—as an adjunct to a single course, learners will make use of the software only for the duration of the course (or even program). They will not want to invest a lot of effort and time in learning software they may very well never use again.

Off-Line Work

Because accessing distant servers via modem can lead to substantial telephone toll charges, it is highly desirable that a CC system have provision for off-line browsing and composing of conference messages and bulk downloading of documents. Ideally, working off-line should closely resemble working on-line in look and feel.

Multimedia Capability

The ability to include non-text materials in messages (such as graphics, sound, or video), while not an essential feature, is a nice bonus. In some courses, indeed, one or more of those components might be essential. Of course, if those kinds of multimedia documents can be made into attachments to the messages, it is less crucial that it be possible that they be included in the message itself.

Address Book

An address book, in which the user can store individual and group lists to which messages can be addressed, should be an essential part of the CC system. The address book should also permit aliases, or short forms of an address or group of addresses. As well, the address book should permit importing and exporting addresses to tab-delimited text files.

Batch Processing

For the sake of the CC system administrator and/or instructors, there should be provision for the batch creation and deletion of users, as well as assignment of powers to users. Ideally, this aspect of administration could use tab-delimited ASCII files as a source, so that entire class lists could be fed into the CC system at one time.

Forms Creation and Integration

The capability to design, create, and use different types of message forms provides numerous possibilities for course by course customization. For example, quiz or survey forms could be used to measure learning or gauge opinion. Data collection and compilation forms unique to the course could be added.

Transparent Integration with the Internet and World Wide Web

Technologies are converging extremely quickly. It is desirable that CC software work transparently with other aspects of the Internet, such as Internet e-mail and WWW

access. If such integration is lacking or is not very transparent and easy to use, users will have to run additional software to access those features.

Chat

A feature whose value may be questionable in an instructional environment is Chat. This feature permits real-time text-based "conversation" between two or more individuals who are connected to the CC server simultaneously. Although it comes in handy from time to time, we say that its value may be questionable because whenever more than two people are involved in a chat session, it can become quite difficult to keep the flow of conversation tolerable. The relative asynchronicity inherent in a chat session makes for considerable confusion, as various individuals pose and respond to different questions without the benefit of some threading mechanism.

Conclusion

In this paper we attempted to provide a useful overview for the educator who is interested in exploring computer conferencing for his or her teaching and learning context. As well as clarifying relevant concepts and terms, we discussed why one might want to use computer conferencing, outlined some of the limitations of CC, and detailed a "shopping list" of desirable attributes for CC software that should help a newcomer to CC sort through the various software packages available.

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